W12SF 3.2 V1

RECORD OF DECISION

REMEDIAL ACTION SELECTION

SITE: Tacoma Well 12A
Commencement Bay/South Tacoma Channel
Tacoma, Washington

Documents Reviewed

I have reviewed the following documents describing the analysis of cost-effectiveness of remedial alternatives for Well 12A in the South Tacoma Channel:

Study Titled: Remedial Investigation, Well 12A
Tacoma, Washington, 2/10/83 (Draft)

Study Titled: Tacoma Well 12A, Remedial Action
Feasibility Study, February 1983

Staff Summaries and Recommendations

Declarations

Consistent with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and the National Oil and Hazardous Substances Contingency Plan, I have determined that the pumping and treatment of Well 12A is a necessary and timely remedial. The action taken is a cost-effective remedy, and it effectively and reliably mitigates and minimizes damage to, and provides adequate protection of public health, welfare and the environment. I have also determined that the action is appropriate when balanced against the need to use Trust Fund money at other sites. In addition, the chosen remedy complies with the requirements of Section 101(24) of CERCLA because off-site disposal is more cost-effective than potential on-site remedies and necessary to protect public health and the environment.

Assistant Administrator
Office of Solid Waste and Emergency Response

Record of Decision Summary Sheet

Commencement Bay/South Tacoma Channel
Tacoma Well 12A

EPA has completed the following Superfund actions at the South Tacoma Channel relative to contamination at Well 12A.

Activity	Date Completed
Surface Source Investigation - Phase I	1/28
Remedial Investigation (Draft)	2/14
Well 12A Remedial Feasibility Study	3/1
Public Meeting	3/10

Region 10 has reviewed the available information and has given careful consideration to the comments received during the public comments period. Based on our review, we have determined that the proposed action at the site is cost effective and necessary to effectively mitigate and minimize further contamination of drinking water. This action will protect public health, welfare and the environment.

Action	Cost	Completion
Establishment of Treatment at Well 12A	$1,150,000	July 1983
System Startup, Monitoring	50,000	October 1983

Operation, maintenance and monitoring costs are estimated to be $60,000 annually.

MAR 16 1983
Date

John R. Spencer
Regional Administrator

WELL 12A REMEDIAL ACTION
EXECUTIVE SUMMARY

In conjunction with several State and local agencies, EPA is proposing a remedial action to allow treatment of water from the contaminated drinking water Well 12A. EPA is working in close conjunction with the State Departments of Ecology and Social and Health Services, the City of Tacoma Water Division and the Tacoma Pierce County Health Department.

The well was discovered to be contaminated with volatile organic solvents about September 1981. At the advice of the Department of Social and Health Services, the City voluntarily removed the water well from service. In April 1982, U.S. Environmental Protection Agency began an investigation of the extent and nature of the contamination found in Well 12A. At the same time, the Tacoma Pierce County Health Department began an investigation as to possible sources of the contaminants. The results of the former investigation demonstrate that there is a contaminated plume with organic solvents in concentrations of parts per million to the northeast of City Well 12A. The ultimate sources of this plume have not yet been identified.

During 1982, Well 12A was out of service but other wells within the wellfield continued to pump. The contaminant plume moved into the wellfield and volatile organics were discovered in nearby Well 9A. This well is now closed. Results of the groundwater investigation indicate that contamination will continue to move into the wellfield as pumping continues unless remedial action is pursued. Without action, the contamination will effectively eliminate Tacoma's source of water for meeting the higher summer demand.

The proposed action is a treatment system in Well 12A which will remove the contamination through aeration. Pumping of Well 12A will provide a barrier to future contaminant migration into the wellfield. Treatment will provide the City with water of acceptable quality for consumption. It is possible that the system will be overloaded by the contaminant levels. In the case that effluent quality falls, the system will discharge to Commencement Bay but at a level sufficient to protect aquatic life.

Several alternatives were examined before selecting this system. The proposal of 5 aeration towers is the most cost-effective of any of the systems evaluated. Cost of the project is about $1.2 million.

Additional work is being done to locate the source of contamination. If this can be accomplished, further measures will be taken to mitigate contamination of the aquifer.

More detailed information can be obtained from the Remedial Action Feasibility Study and by contacting EPA Region 10.

NARRATIVE SUMMARY

HISTORY

Tacoma Well 12A is within the South Tacoma Channel Commencement Bay Superfund designation. This area of Tacoma, Washington is a commercial industrial zone with a long history of development.

In September 1981, volatile organic contaminants were found in the well. At the advice of the State Department of Social and Health Services, the well was removed from service by the City. At that time, the concentration was several hundred parts per billion, including tetrachloroethane, trichloroethylene and dichloroethylene.

In October, Commencement Bay was listed on the Interim Priority List. A remedial groundwater investigation was initiated to determine the extent of contamination and potentially locate a source. Concurrently, surface investigations looked at business types to identify those which may have contributed to the problem.

To date, no source has been identified. However, a plume of contamination has been located giving a general direction, northeast, to the primary source. Concentration within the plume is several parts per million.

During 1982, Well 12A was out of service. All of the other wells were in operation during the summer pumping season. Analysis of these other wells showed that an additional well had become contaminated. This well was the closest to 12A, immediately southwest. The groundwater study confirmed that should the contaminated wells closest to the source remain shut down, pumping of the other production wells would draw contaminants closer and evidently all the wells would be tainted.

With two wells contaminated and to be held out of service, the City of Tacoma is placed in a situation of water shortages during the summer. Further, if contamination is permitted to move into the wellfield, 30% of the total water system capacity would be lost.

CURRENT STATUS

The remedial action feasibility study addresses the options for mitigation. They are generally 1) no action and abandonment of the contaminated wells, 2) alternative water supply, and 3) treatment.

No action is an unacceptable option as it does nothing to protect the drinking water supply and quality for the City of Tacoma. Without some mitigation, contamination would move within the aquifer to other wells.

TACOMA WELL 12A/COMMENCEMENT BAY

REMEDIAL ACTION FEASIBILITY STUDY

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
FEBRUARY 1983

THIS IS A DRAFT DOCUMENT CURRENTLY UNDERGOING ADMINISTRATIVE AND PEER REVIEW.

No alternatives sources of water exist for the City in the short term. The wellfield is essential to the City's future drinking water planning.

Pumping and treatment of Well 12A would be the only alternative capable of protecting the groundwater aquifer and alleviating drinking water shortages. Pumping of the well will provide an effective hydraulic barrier to contaminant movement within the aquifer. Treatment of the water will allow the City to use the water as its quality permits or to discharge the water to Commencement Bay at a quality sufficient to protect marine life.

Treatment at Well 12A is an interim measure. As a source or sources can be identified, actions for local control at the source may be more effective in mitigating contamination in the aquifer.

Treatment alternatives evaluated consisted of activated carbon and aeration, among others. After evaluating factors of cost effectiveness, technical feasibility, environmental effects and implementability, an aeration system of 5 towers was selected. Estimated cost is $1.2 million.

PUBLIC INPUT

On March 10, 1983, a public meeting was held to the proposed action. Concurrently, public comment was solicited from information made available. A responsiveness summary is attached in this package.

STATE INPUT

The State of Washington, through its Departments of Ecology and Social and Health Services, along with the City of Tacoma and the Tacoma Pierce County Health Department, have cooperated with Region 10 and have supported this project. The State/EPA contract is attached in the package.

RECOMMENDED ALTERNATIVE

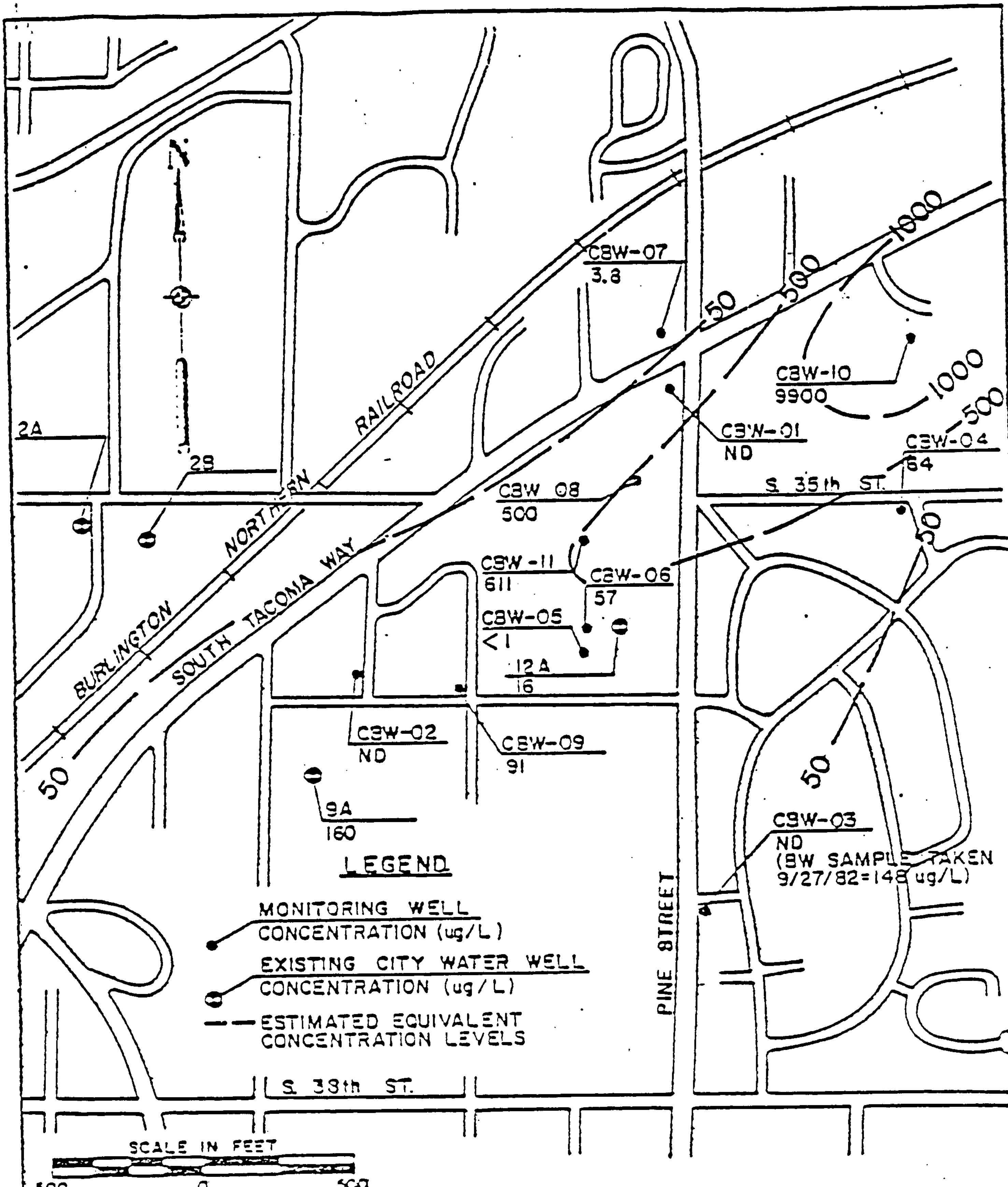
Section 300.68(j) of the National Contingency Plan (NCP) [47FR 31180, July 16, 1982] states that the appropriate extent of remedy shall be determined by the lead agency's selection of the remedial alternative which the agency determines is cost-effective (i.e., the lowest cost alternative that is technologically feasible and reliable and which effectively mitigates and minimizes damage to and provides adequate protection of public health, welfare, or the environment. Based on our evaluation of the cost-effectiveness of each of the proposed alternatives, the comments received from the public, information from the Site Investigation and Feasibility Study Reports, and information from the State, the proposed project is treatment of a contaminated drinking water well by aeration, utilizing the pumping at a hydraulic barrier. Water from the system could be used within the drinking water system or discharged as the effluent quality dictates.

This proposed action will effectively mitigate damage to and provide adequate protection of public health, welfare, and the environment.

Approval of this project is requested along with approval of an allocation for $1.2 million for its implementation as needed above, the State of Washington has endorsed the project and has assumed a 10% cost share.

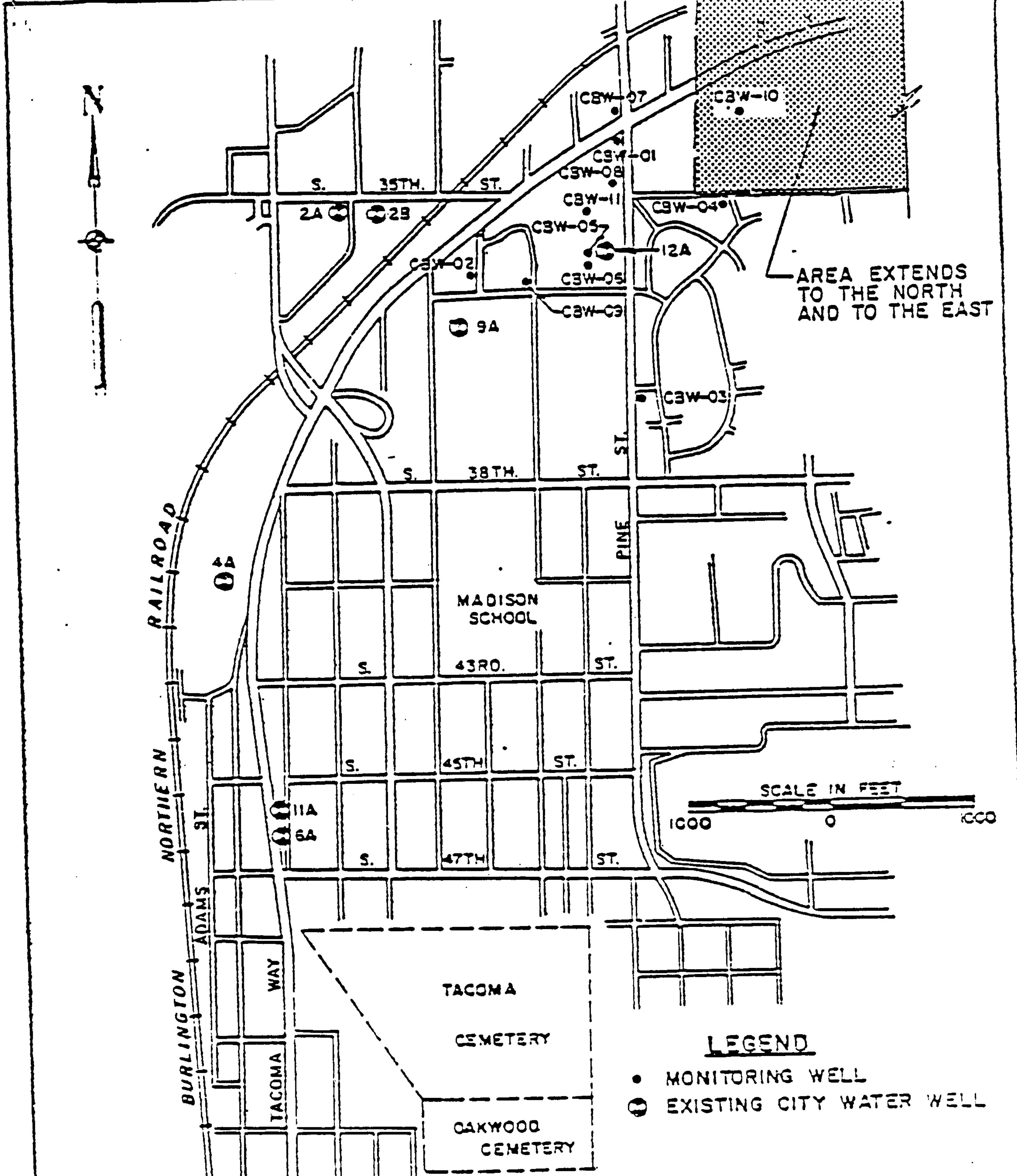
SCHEDULE

This project is based upon a hydraulic barrier being developed prior to heavy usage of the wellfield. This would dictate project start up in July 1983. Immediate authority is required to complete design and construction by this deadline.



AREAL DISTRIBUTION OF 1,1,2,2 TETRACHLOROETHANE
FROM OCTOBER 27, 1982 TO NOVEMBER 30, 1982

REMEDIAL INVESTIGATION
TACOMA WELL 12A
TACOMA, WASHINGTON



PROBABLE PRIMARY SOURCE AREA

REMEDIAL INVESTIGATION
TACOMA WELL 12A
TACOMA, WASHINGTON

FIGURE 1

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- Continuing Efforts to Identify Sources
- Community Relations

SUMMARY

The South Tacoma Channel site within the Commencement Bay area is one of the top 100 sites on the proposed Superfund National Priority List. This site includes an area of approximately 10 square miles throughout a heavily industrial and commercial area. Although there are several potential areas of concern within the South Tacoma Channel, the first problem to be addressed is the contamination of the City of Tacoma drinking water wells with chlorinated organic solvents. In September 1981, these solvents were detected in City Well 12A. The well was voluntarily removed from service by the City in cooperation with the State Department of Social and Health Services.

In April 1982, U.S. Environmental Protection Agency began an investigation of the extent and nature of the contamination found in Well 12A. This study was designed to identify the direction of the contamination and the source of the problem. At the same time, the Tacoma Pierce County Health Department began an investigation as to possible sources of the contaminants. The results of the former investigation demonstrate that there is a contaminated plume with organic solvents in concentrations of parts per million to the northeast of City Well 12A. The ultimate sources of this plume have not yet been identified.

This feasibility study was developed to assess temporary remedial measures to prevent the spread of the contaminated plume to the remainder of the City of Tacoma wells and to supply the City with enough water to meet summer water demand for the next several years. These measures are considered to be temporary because the EPA and the State of Washington expect to identify the source of the pollutants and to institute source control measures to remedy the problem. Additional investigations are underway to determine that source.

The study assesses the need for remedial action and evaluates alternatives for that action. In identifying the need for remedial action, the historical need for water from the well field and the risks associated with using the water were evaluated. In determining these risks, assumptions were made to identify the risk associated with both a worst case and a best case, thus providing a set of bounds for the expected risk. These assumptions were based upon information on the nature and extent of contamination.

The remedial alternatives available to treat the water, should treatment prove necessary, were screened based on technical feasibility and economics. The least costly, technically feasible alternative, air stripping, was further analyzed to determine the most cost effective configuration for treatment.

Based on this analysis, a system of five air stripping towers is recommended. This system will provide treatment capacity for a flow

adequate to allow Well 12A to act as a barrier well and protect the rest of the well field. Depending upon the pollutant contamination concentration in the water being pumped from Well 12A, this treatment system will deliver water of a sufficient quality to use in the drinking water system or for discharge to Commencement Bay.

The system will operate on a seasonal basis during the time of wellfield pumping commencing this year. The barrier well is necessary only during this period. This operation could be changed with the development of a final remedial.

IDENTIFICATION OF THE PROBLEM

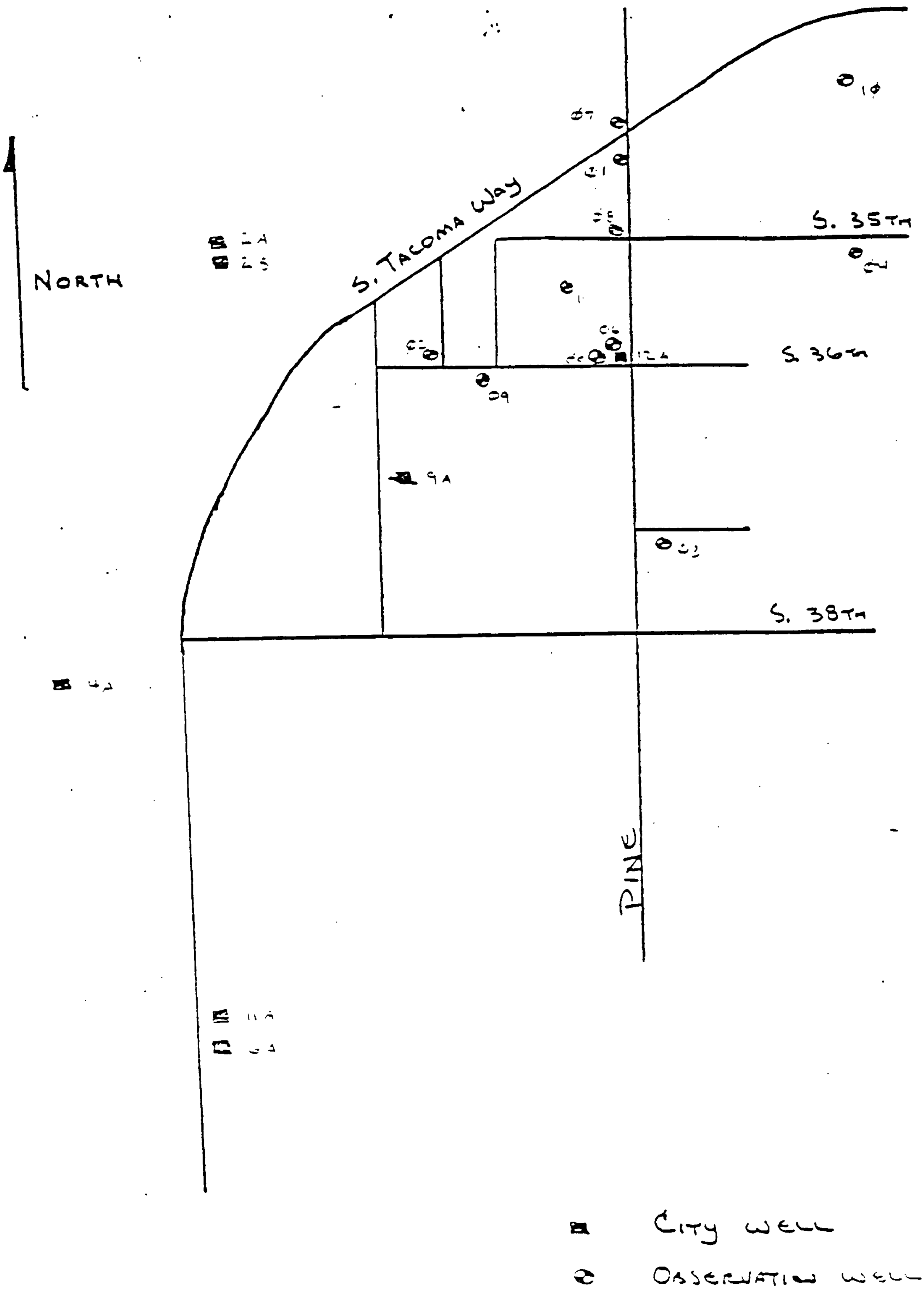
Chlorinated hydrocarbons were detected in groundwater samples from the City of Tacoma Well 12A on July 24, August 21, August 27, and September 15, 1981. The range of concentrations for the detected contaminants is listed in parts per billion (ppb) below:

1,1,2,2-Tetrachloroethane	17 to 300 ppb
1,2-Trans dichloroethylene	30 to 100 ppb
Trichloroethylene	54 to 130 ppb
Tetrachloroethylene	1.6 to 5.4 ppb

Well 12A had been pumped on demand for approximately one to three months prior to sampling.

Groundwater sampling programs were also initiated at Wells 9A and 11A during the latter part of the summer of 1981. The contaminants which were detected in Well 12A were also present in groundwater samples from Well 9A but at much lower concentrations.

The scope of the Remedial Investigation consisted of installation of eleven groundwater monitoring wells; subsurface soil sampling during well installation; shallow subsurface soil sampling to a depth of 30 feet at four locations; groundwater sampling in the well borings prior to completion of the wells; groundwater sampling of the eleven monitoring wells after completion, selected City of Tacoma wells, and private wells in the vicinity of Well 12A; and analysis of the resulting geologic, hydrogeologic, and laboratory data. The locations of the eleven monitoring wells are shown on the following map.


NORTH
S. TACOMA WAY
S. 35TH
S. 36TH
S. 38TH
PINE
9A
12A
CITY WELL
OBSERVATION WELL

SUMMARY OF RESULTS FROM GROUNDWATER INVESTIGATION

The groundwater investigation conducted by EPA and its consultants, Black and Veatch and Woodward Clyde Associates, provided a great deal of information about the water supply aquifer and the direction in which the pollutants are moving.

The regional, undisturbed, steady-state flow in the study area is from west to east. The potentiometric surface is very flat, however, and the seasonal pumping of the well field at very high flows has depressed that surface throughout the study area. Therefore, the flow of the groundwater has been reversed and flow is now directed towards the well field, in the area of concern.

The investigation found a contaminant plume in a highly permeable interval at 150 ft. to 200 ft. elevation, the level in which the City wells are screened. Monitoring Well 10, in an area to the northeast of City Well 12A, has concentrations of the pollutants of concern that are more than 10 times higher than the concentrations found at Well 12A in September 1981. A concentration gradient exists in the aquifer between monitoring Well 10 and Well 12A. This gradient is a function of the pumping history of the City wells in the area and the groundwater flow induced by that pumping. The boundaries of the plume have not been defined.

Assuming that hydrogeologic conditions in the area do not change, it is likely that the contaminant concentration in Well 12A will increase with time as the well is pumped. Similarly, if Well 9A is pumped while Well 12A is shut down, it is likely that concentrations in 9A would increase with time. If both Wells 9A and 12A are shut down for any period of time while Well 11A is pumped, it is probable that the contaminant concentrations in Well 11A would increase with time. Well 9A has already shown contamination and has been removed from service.

The increase in concentration of these pollutants at Well 9A was demonstrated during the summer of 1982 when Well 9A was pumped and Well 12A was idle. In September 1981, 9A had trace concentrations of tetrachloroethane, trichloroethylene, and transdichloroethylene. In October 1982, after a full summer of pumping, the concentrations of those pollutants were 120 ppb, 50 ppb, and 30 ppb, respectively.

BACKGROUND ON TACOMA WELLFIELD

The City of Tacoma uses a wellfield of 13 wells located in the South Tacoma Channel as a supplementary source of water to meet peak summer demand. During the months of July, August and September, the wells supply as much as 30% of the total water system flow, averaged over a 30 day maximum demand.

Data from the City records are shown below. It shows the maximum wellfield demand for the 30, 4, and one day peak demand over the past 10 years. Wellfield capacity is 45 millions gallons per day (mgd) including Wells 12A and 9A which provide approximately 6 and 4 mgd respectively. The records show clearly that without the contaminated wells in service, the 30 day peak demand would not be met and that the shorter peak period demands cannot be met even with all wells pumping at maximum flow.

During the 4 day peak, reservoir capacity is completely used. During these times, wellfield capacity is taxed and aquifer stress and drawdown is maximum.

	30 day	4 day	1 day
Maximum demand, mgd	108	121	128
Demand on wellfield	36	49	55

Maximum wellfield capacity	45 mgd
Capacity without 12A	39 mgd
Capacity without 12A, 9A	35 mgd

With the exception of 9A, all wells can be channeled through the Hood Street reservoir. 9A delivers directly into the distribution system and at peak flow other wells also run to distribution. Well 12A runs only to the reservoir. Dilution of Well 12A in the reservoir is 1 in 6.

PROJECTED CONCENTRATIONS OF THE CONTAMINANTS

In order to evaluate the risks associated with taking no action to treat the groundwater used by the City of Tacoma, the future movement of the plume discovered during the investigation must be projected. There are many variables associated with this kind of projection. For example, the size and nature of the plume must be known or assumed. The time frame of concern must be estimated and pumping rates of the wellfield must also be projected. Because of all of these variables, the intent of this analysis is not to identify an exact concentration or risk. Rather, the intent is to make reasonable assumptions which allow the limits of the risk to be estimated. The first step is to project reasonable limits to the concentration of pollutants in the water system.

It is assumed that the timeframe of concern is the near future, the next five years. This assumption is based upon anticipated discovery of a source of contamination during the next phase of the investigation. A source control measure will then be implemented to correct the problem. Therefore, the concentrations expected in the wellfield for the next five years under present conditions are of most concern.

Because the results of the investigation did not identify the boundaries of the contaminated plume, aquifer concentrations were projected for two possible types of sources. The first type would be a relatively small source, localized near monitoring well 10. The second plume assumed was geographically large, as from a very large source, extending to the north and northeast of monitoring well 10. These two assumptions provide reasonable limits on the possible types of plumes in the aquifer and will thus bracket the actual plume type.

Another set of assumptions has been made regarding the use of Well 12A. When Well 12A is pumping at 2000 gallons per minute or more, it acts as a barrier well to the rest of the wellfield. That is, the well creates a hydraulic barrier, which prevents groundwater, and therefore pollutants, from moving from the area of monitoring well 10 towards the rest of the Tacoma wellfield.

If Well 12A is pumped, the concentration of pollutants at Well 12A will be diluted by the water from the other wells serving the Hood Street reservoir. If it is not pumped, the concentrations of the pollutants at Wells 9A and 11A are expected to increase gradually as the plume is pulled toward the wellfield. This will increase the concentrations in the water supply system. The concentrations of the pollutants in the water supply were estimated both with and without use of Well 12A for the next five years.

These assumptions define four scenarios:

(1) Small source, Well 12A pumped

(2) Large source, Well 12A pumped

(3) Small source, Well 12A not pumped

(4) Large source, Well 12A not pumped

In making these estimates, it was assumed that the concentrations at the wells would only be diluted by the other wells on the system and that no removal of the pollutants would occur in the Reservoir or during chlorination. This is a conservative assumption.

Scenario 1: If the source is small and Well 12A is pumped, it is reasonable to estimate the concentrations at Well 12A to be similar to those observed at the well at the end of the pumping season in 1981. A total organic concentration of 1000 ppb or 1 part per million (ppm) is estimated. Because the other wells in the wellfield would remain uncontaminated if Well 12A is pumped, the water from Well 12A would be diluted in the Hood Street Reservoir.

Scenario 2: If the contamination is from a very large source and the highly contaminated plume extends far to the north and east of monitoring well 10, it is reasonable to assume that the concentrations now found at monitoring well 10 will move to Well 12A and the water pumped from Well 12A will have an organic concentration approaching 15,000 ppb or 15 ppm. Again, this water would be diluted by the clean water from the rest of the wellfield so that the water entering the system will have concentrations of approximately 2500 ppb.

Scenario 3: If the source of the contamination is small and Well 12A is not pumped, the contaminants will move slowly into the wellfield. If these wells are affected, there is little other water with which to dilute the contaminated water. It is assumed that under these conditions, the concentrations found at 9A and 11A will remain at the concentrations found at 9A at the end of the 1982 pumping season.

Scenario 4: If the source of the contamination is very large and Well 12A is not pumped, it is assumed that the concentrations in Wells 9A and 11A will approach that found in Well 12A at the end of the 1981 pumping season. Therefore, the concentrations entering the system will approach 1000 ppb.

ENDANGERMENT ASSESSMENT

The risk assessment which has been developed is very basic in nature. It attempts to demonstrate incremental cancer excess risk to a population consuming untreated water from Well 12A based on a variety of assumptions. These assumptions are stated below and have been made in such a manner as to provide maximum protection to public health while at the same time considering cost effectiveness. (See Section on Alternatives Analysis).

There are three primary contaminants of Well 12A: 1,1,2,2-tetrachloroethane, ~~trichloroethylene, and 1,2-trans-dichloroethylene.~~ All three are used as general solvents, although each has additional specific uses.

The 1,1,2,2-tetrachloroethane, being a solvent for oils, resins, and tarry substances, will cleanse and degrease metals and rubber. It is used in paint and rust removers, varnishes, lacquers, insecticides, and weed killers. Additionally, certain types of paints and, occasionally, dry cleaning formulations, can contain this substance.

Trichloroethylene is primarily used as a vapor degreaser of metal parts. It is the principal solvent for cleaning aluminum, and is frequently used to clean other metals of oils, fats, and waxes. Trichloroethylene also finds use in dry cleaning and textile operations, and in the manufacture of paints and adhesives.

The other major contaminant, 1,2-trans-dichloroethylene, is a general solvent for organic materials such as waxes and resins. It also has applications in dye and rubber extractions, perfumes, lacquers, refrigeration, and the extraction of oils and fats from fish and meat.

Assumptions - General:

1. Analytical data are accurate and engineering predictive projections are appropriate.
2. Risk levels for increased cancer incidence as developed for the Water Quality Criteria Document (WQCD) are appropriate.
3. Water from Well 12A will be used as a drinking water source for a period of 90 days each year and this will continue for a lifetime for individuals using that water source.
4. It is appropriate to average the exposure experienced during the 90 day period over the entire year. That is to say, exposure to a contaminant at a concentration of 40 parts per billion (ppb) for 90 days is equivalent to exposure of the same contaminant at a concentration of 10 ppb for 360 days (approximately one year).

5. The dilution factor, assuming 3500 gal/min flow rate at Well 12A, is six.

6. The total risk associated with exposure to the three major contaminants found in Well 12A is equal to the sum of the risks associated with each individual contaminant. There are several possibilities for how the combined effect of several pollutants can be evaluated. The state of scientific knowledge of the chemicals found in Well 12A (as well as most others) precludes us from being able to make either quantitative or qualitative assumptions about potential synergistic interactions. As a result, the premise chosen in this assessment is that the risks are additive.

7. The maximum concentration of pollutants in the raw water will not exceed the treatment capacity of the proposed system.

8. Predicted incremental cancer excess rates associated with lifetime exposure (via drinking water) are as follows:

1,1,2,2-Tetrachloroethane	$\frac{10^{-4}}{17.0}$	$\frac{10^{-5}}{1.7}$	$\frac{10^{-6}}{0.17}$	(WQCD)
1,2-Trans-dichloroethylene	$\frac{10^{-4}}{3.3}$	$\frac{10^{-5}}{0.33}$	$\frac{10^{-6}}{0.033}$	(WQCD, See Assumption 9)
Trichloroethylene	$\frac{10^{-4}}{270}$	$\frac{10^{-5}}{27}$	$\frac{10^{-6}}{2.7}$	(WQCD)

The following explanations may help clarify the meanings of the numbers:

10^{-4} associated with 17.0 ug/l means that if a person is exposed to 17.0 ug/l of 1,1,2,2-tetrachloroethane in drinking water for a lifetime (70 years) the probability that that person may die of cancer caused by the exposure to 1,1,2,2-tetrachloroethane is 1 in 10,000 or 10^{-4}. Alternatively it also means that if 10,000 people were exposed to 17 ug/l 1,1,2,2-tetrachloroethane for a lifetime, one would expect (statistically) one cancer death to be caused in that population by the exposure.

9. The risk factor for 1,2-Trans-dichloroethylene is assumed to be equivalent to the risk factor for 1,1-dichloroethylene. (Note: No Risk factor could be found for 1,2-Trans-dichloroethylene).

10. Because of the impreciseness of the assumptions made, the risk factors are also imprecise and should be expressed as orders of magnitude rather than given specific values.

11. At high concentrations of contaminants, the relationship between risk and concentration is linear.

12. Water from the well is thoroughly mixed and the dilution factor is 6.

CASE 1 NO TREATMENT AT PRESENT CONCENTRATIONS
3500 gal/min flow rate

ASSUMPTION: Concentrations of contaminants in raw 12A water are as follow:

1,1,2,2,tetrachloroethane	350 parts per billion (ppb)
1,2,trans-dichloroethylene	200 parts per billion (ppb)
trichloroethylene	450 parts per billion (ppb)

1,1,2,2-Tetrachloroethane

350 ppb for 90 day exposure $\left(\frac{350}{4}\text{ ppb} = 87.5\text{ ppb}\right)$(Assumption # 4)

87.5 ppb for 360 day exposure $\left(\frac{87.5}{6}\text{ ppb} = 14.6\text{ ppb}\right)$(Assumption # 6)

14.6 ppb for 360 day exposure with dilution factor of 6

Where x = Risk:

$$\frac{14.6}{x} = \frac{1.7}{10^{-5}}$$

$$1.7\,x = 14.6 \times 10^{-5}$$

$$x = \frac{14.6}{1.7} \times 10^{-5}$$

$$\text{Risk} = \underline{9 \times 10^{-5}} = \text{(approx) } 10 \times 10^{-5} = 10^{-4}$$

(Based on WQCD)

Total Risk

Total Risk = Risk (1,1,2,2-tetrachloroethane) +
Risk (1,2-trans-dichloroethylene) +
Risk (Trichloroethylene)

$$\text{Total Risk} = 9 \times 10^{-5} + 25 \times 10^{-5} + 0.7 \times 10^{-5}$$
$$= 34.7 \times 10^{-5} = \text{(approx) } \underline{3.5 \times 10^{-4}}$$

These calculations indicate that the risk exceeds one excess cancer death per ten thousand people drinking the water for a lifetime.

CASE 2 NO TREATMENT AT HIGHER CONCENTRATIONS
3500 GAL/MIN FLOW RATE

Assumption: Concentrations of contaminants in raw 12A water are as follow:

1,1,2,2-tetrachloroethane	5000 ppb
1,2-trans-dichloroethylene	3000 ppb
trichloroethylene	7000 ppb

1,1,2,2 - Tetrachloroethane

5000 ppb for 90 day exposure

1250 ppb for 360 day exposure

208.3 ppb for 360 day exposure

Where x = Risk:

$$\frac{208.3}{x} = \frac{1.7}{10^{-5}}$$

$$1.7x = 208.3 \times 10^{-5}$$

$$x = \frac{208.3}{1.7} \times 10^{-5}$$

$$\text{Risk} = 122.5 \times 10^{-5} = \text{(approx) } \underline{1.2 \times 10^{-3}}$$ (Based on WQCD)

1,2-Trans dichloroethylene

200 ppb for 90 days exposure

50 ppb for 360 day exposure

8.3. ppb for 360 day exposure with dilution factor of 6

Where x = Risk

$$\frac{8.3}{x} = \frac{0.33}{10^{-5}}$$

$$.33x = 8.3 \times 10^{-5}$$

$$x = \frac{8.3}{0.33} \times 10^{-5}$$

Risk = 25.15×10^{-5} = (approx) $\underline{2.5 \times 10^{-4}}$

(Based on WQCD)

Trichloroethylene

450 ppb for 90 day exposure

112.5 ppb for 360 day exposure

18.8 ppb for 360 day exposure with dilution factor of 6.

Where x = Risk:

$$\frac{18.8}{x} = \frac{27}{10^{-5}}$$

$$27x = 18.8 \times 10^{-5}$$

$$x = \frac{18.8}{27} \times 10^{-5}$$

Risk = $\underline{0.71 \times 10^{-5}} = 7 \times 10^{-6}$ (Based on WQCD)

Risk = $\underline{10.8 \times 10^{-5}}$ = (approx) 0.11×10^{-3} (Based on WQCD)

(Alternatively, based on SNARL and calculated as above,
Risk = (approx) $\underline{6.5 \times 10^{-5}}$

Total Risk No Treatment, Higher Concentrations	$= 1.20 \times 10^{-3} + 3.80 \times 10^{-3} + 0.11 \times 10^{-3}$ $= 5.11 \times 10^{-3}$

These calculations indicate that the risk exceeds one excess cancer death per thousand people drinking the water for a lifetime.

* * *

SCREENING OF ALTERNATIVES

Potential remedial action alternatives include no action, abandonment of Well 12A, containment through plume control, aquifer replacement, and treatment at 12A.

The no action alternative has been previously discussed. Abandonment of 12A is not acceptable since the contamination will migrate and show up in other wells, notably Wells 9A and 11A. This has already happened in Well 9A.

Containment of the pollutants through source control may be a viable alternative in the future. However, analysis of this option requires more information about the plume and the source of the problem than is currently available.

Aquifer replacement with a new water supply cannot be evaluated until the cause and extent of the existing problem is understood. Moreover, there are no other water sources which can begin supplying water immediately.

Pumping and treating Well 12A is the only remedial alternative which can be implemented on an interim basis until the full extent of the problem has been assessed. Conventional treatment processes such as coagulation, sedimentation, precipitative softening, filtration, and chlorination have been found to be ineffective for controlling the volatile organics of concern. Ozone has been used in laboratory and pilot studies, but with only limited success. The technologies worthy of consideration include aeration and adsorption.

Two types of aeration are generally used to strip volatile compounds from aqueous solution. Diffused aerators bubble air up through the water while towers function through water cascading downward through the air.

In the diffused-air type system, stripping is accomplished by injecting air bubbles into the water by means of submerged diffusers or porous plates. Usually untreated water enters the top of a basin, treated water exits at the bottom, and exhausted air leaves the top. Gas transfer can be improved by increasing basin depth, improving the contact basin geometry, and by reducing the bubble size.

In contrast, the tower-type treatment process accomplishes the same end results by water falling through the air and breaking into small drops on thin films. For the removal of volatile organics, packed columns are used where the packing material provides high void volumes and high surface area. The water flows downward by gravity and air is forced upward. If air is pulled upward by a fan on top of the column it is called an induced draft packed tower. More common is the force draft packed tower where a blower positioned at the bottom of the tower forces air upward through the packing.

Adsorption of the volatile organics can be accomplished with a synthetic resin. In 1976 an experimental synthetic resin was introduced for removing low molecular weight halogenated compounds. Since that time there have been several experimental pilot-scale projects concerning the treatment of solvent contaminated groundwater. Although this material shows promise because of its high adsorption capacity, the manufacturer recently (1982) announced that the material would not be commercially produced. Therefore, resin adsorption is not an implementable alternative at this time.

Adsorption by granular activated carbon (GAC) is a viable treatment technology. Adsorption units are usually operated in series in a manner that allows each adsorption vessel to remain on-line until the activated carbon reaches its capacity, after which it must be replaced. The adsorbent is then regenerated and available for reuse. The effectiveness of GAC depends on the type and concentration present in the groundwater. The unsaturated organics, such as the ethlyenes, tend to be more readily adsorbed on carbon than the saturated compounds, such as the ethanes including 1,1,2,2 tetrachloroethane, which is of concern in this case.

Table 1 shows the costs for the most feasible control technologies including diffused-air stripping, tower stripping, and GAC adsorption. The cost analysis is based on studies for removing trichloroethylene at a flow of 0.5 million gallons per day. A complete treatment system is assumed, including one of the three technologies cited above followed by chlorination, clearwell storage, and high-lift pumping.

TABLE 1

TYPE OF TREATMENT	TOTAL TREATMENT COST IN DOLLARS PER 1000 GALLONS
Granular Activated Carbon	0.7
Packed Tower	0.2
Basin Aeration	0.7

An influent concentration of 1.0 is assumed with 90 percent removal.

The costs are useful for a relative comparison of treatment alternatives and clearly show packed tower stripping to be the most cost-effective. The costs, however, should not be used as absolute estimates since they are based on the removal of trichloroethylene, whereas 1,1,2,2 Tetrachloroethane is considered as the controlling substance in this particular case. Also, as an interim remedial measure, the control technology may not be used at this site for its entire useful life and it will not be operated throughout the year. This will affect possible salvage value and the operation and maintenance cost. However, these factors should not alter the conclusion that packed tower stripping is the most cost-effective treatment alternative.

EVALUATION OF ALTERNATIVES

Introduction

Based on the technical treatment alternatives presented above, a detailed literature evaluation of recorded field tests, computer modeling, and actual pilot tests, it has been concluded that the only appropriate and cost-effective technology for removal of the volatile organic contaminants (VOCs) in Well 12A, is forced air stripping in a packed tower system.

The only other technology actively considered was granular activated carbon adsorption. However, the literature reports, for the specific contaminants of concern, contaminant removal efficiencies significantly less than those given for forced air stripping. CH_2M HILL lab tests developed preliminary carbon isotherms for the contaminants in question, and confirmed the fact that carbon adsorption is not cost-effective.

Fundamental Design Parameters

Fundamental design parameters that must be considered when developing the process design and sizing for an air stripper tower are flow, total contaminant level and contaminant distribution, and the percent removal required for the contaminants of concern.

A flow rate of 3,500 gpm will provide the maximum blocking effect in terms of containment of the contaminant plume as it is drawn into the operating well field. The minimum acceptable flow rate from Well 12A would be 2,000 gpm. Based on an analysis of historical sampling data, it has been determined that the major contaminant distribution will be as follows:

1,1,2,2 - Tetrachloroethane	35 percent
1,2 - Trans-dichloroethylene	20 percent
Trichloroethylene	45 percent

From the cost curves that will be shown later, it has been determined that the most cost-effective removals are in the 90 percent range. Consequently for the contaminant distribution given above, various forced-draft air stripping tower designs were developed for percent removals in the 90 $\pm$ percent range.

A preliminary review of all the data suggested that the primary contaminant of concern, with respect to its removability, was 1,1,2,2-tetrachloroethane. To put this problem into perspective it must be understood that the removal of VOCs in a packed tower is a direct function of each contaminant's Henry's Law Coefficient. The Henry's Law Coefficient for trichloroethylene, for example, at 48° F is 290 atmospheres. The Henry's Law Coefficient for 1,1,2,2-tetrachloroethane is 11. The Henry's Law Coefficient for the other two remaining contaminants are the same or greater than that of trichloroethylene. Consequently, since removal efficiency is a linear function of the relative Henry's Law Coefficient, 1,1,2,2-tetrachloroethane is 25 times more difficult to remove than trichloroethylene. This situation was also observed with respect to the removal of these contaminants by granular-activated carbon, and was also born out by the technical literature.

Pilot Plant Testing

Following a detailed literature review of forced air stripping of the VOC's in question, a series of lab scale pilot plant tests were conducted to verify the removal efficiencies of the compounds and to determine if there were any synergistic or antagonistic effects of the compounds upon each other interfering with removal. CH_2M HILL, in conjunction with the U.S. Bureau of Mines Research Laboratory in Albany, Oregon, developed a pilot test procedure, assembled the necessary equipment, and completed the necessary tests to verify the process design parameters necessary to provide scale-up data for a full-size operating system. The results that were observed from the pilot testing compared favorably to those reported in the technical literature. As predicted, the primary contaminant that dictated the overall percent removal of contaminants was 1,1,2,2-tetrachloroethane. Figure 1 shows the percent removal of 1,1,2,2-tetrachloroethane versus the percent removal of the other three contaminants of concern. As can be seen, a reasonable percentage removal (90$\pm$ percent) of 1,1,2,2-tetrachloroethane assures almost complete removal of the other contaminants.

It was also observed in the pilot tests that in order to achieve respective removals of 1,1,2,2-tetrachloroethane, the liquid to gas ratio (L/G) in the pilot test column had to be extremely small and the liquid loading rates had to be kept low with respect to normal packed tower operation. For example, removal of trichloroethylene in conventional packed tower systems normally requires a liquid loading rate of 25 to 30 gpm per square foot of tower surface area. To affect the same removals of 1,1,2,2-tetrachloroethane, the liquid loading rates had to be dropped to approximately 2 gpm per square foot. Likewise the air flow rates had to be increased proportionately to maintain a low L/G loading rate.

Pilot plant data was obtained for influent contamination levels of 500, 1,000, and 1,500 ppb total volatile organic hydrocarbons. Enough data was obtained to provide the necessary scale-up of process parameters to a full size operating system over a variety of influent conditions. The computer model will predict the percent removal efficiency of the contaminants in question as well as the physical design parameters for the stripping tower. The model will also develop a capital and operating cost for the chosen system.

CH_2M HILL found this computer simulation technique valuable in quickly evaluating a number of alternative stripper tower configurations, flow rates, removal efficiencies, etc. Good correlation between the computer simulation data and the actual data that was taken from the CH_2M HILL pilot plant testing was also observed.

Tower Sizing/Optimization

Tower packing material ranges in price from $15 per cubic foot to as much as $95 per cubic foot, and consequently requires an optimization of cost versus removal efficiency for the particular systems in question. This optimization proved that conventional, Intalox plastic saddles would be the most cost-effective packing to be used in tower systems. Further, it was determined that a 12-foot-diameter tower would be the most cost-effective tower size from the standpoint of providing the necessary surface area, the minimum number of towers and the structural integrity necessary to support a packing depth of approximately 21 feet of Intalox saddles.

It should be noted that on a parallel path to developing and optimizing a packed tower configuration, the use of conventional cooling towers was also investigated. Conventional cooling towers provide very efficient distribution of water across a broad surface area as well as efficient mass transfer via high air flow rates from an axial, induced draft fan, as opposed to a forced-draft blower used in a packed tower configuration. Because of the low liquid and gas loading rates necessary to remove the 1,1,2,2-tetrachloroethane, it was reasoned that the same removal efficiencies could perhaps be obtained in a cooling tower rather than a pack tower with a considerable economy. It was finally agreed that this would likely be the case but that an actual pilot test would be necessary to verify the efficiency of a cooling tower versus a packed tower. At present, none of the cooling tower suppliers that were contacted are set up to undertake such a test. However, because of the significant potential capital cost savings, it is recommended that the subject of cooling towers be investigated in more detail for the final remedial measures that might ultimately be adopted for the Well 12A site. It must be stressed that, although cooling tower technology is well established, its use for the stripping of VOC is not proven and fundamental design parameters therefore must be established to assure that the necessary mass transfer can be affected within the cooling tower system ultimately evaluated.

Cost Effectiveness

Figure 2 depicts cost effectiveness curves for a 2000 gpm and 3500 gpm system. As can be seen, for a 3500 gpm system it is very cost effective to consider going from a 4 to 5 tower system in terms of the percent removal of 1,1,2,2 tetrachloroethane versus cost. However, beyond 5 towers, the curve breaks sharply upward. In a similar manner, for a 2000 gpm system, the curve breaks sharply upward beyond a 3 tower system. These same conclusions can be drawn from an examination of Figure 3 which depicts capital cost, per tower, as a function of the ppb of 1,1,2,2 tetrachloroethane remaining after stripping.

The cost data developed and presented in Figure 2 clearly demonstrates that 5 tower system, for 3500 gpm, and a 3 tower system, for 2000 gpm, are the most cost effective alternatives for treatment at the Well 12A site. Either of these options will achieve approximately 90% removal of the major contaminant of concern, i.e., 1,1,2,2 tetrachloroethane. Recall that the removal of this contaminant at the 90% level, will effect the removal of all other contaminants to levels in excess of 99%.

The only remaining question then is what is the most appropriate system flow rate upon which to base the final system design.

Recommendation and Rationale

Based on all of the above data and a critical analysis of the Well 12A site contaminant level and geohydrological conditions, it is recommended that a treatment system at Well 12A be installed to accommodate a flow rate of 3,500 gpm and a maximum influent design contaminant level of 1,000 ppb total VOC. Such a system, to effect approximately 90 percent removal of 1,1,2,2-tetrachloroethane and a 99+ percent removal of the remaining contaminants will require the installation of five, 12-foot-diameter forced-air stripper towers. Each tower will require approximately 29,000 standard cubic feet per minute (scfm) of air per tower, 21 feet of 1-inch Intalox saddle packing, and will have a total height, with stack, of approximately 50 feet.

Regarding the recommended 3500 gpm flow rate, the following items support this recommendation:

1. 3500 gpm will provide the maximum containment blocking effect at Well 12A, thereby minimizing the potential for contamination of the total aquifer by the contaminant source during the pumping season.

2. 3500 gpm will effectively draw contaminants from nearby Well 9A, which is also presently contaminated and out of service. The ultimate use of Well 9A for municipal supply is essential if the City of Tacoma is to meet its summer water demands. A 3500 gpm flow rate at 12A, as opposed to 2000 gpm (the minimum acceptable blocking flow rate) will provide a much quicker recovery of Well 9A, likely within one pumping season.

3. As mentioned previously, the estimated total influent contamination level of 1000 ppb VOC was based on a 3500 gpm pumping rate. If the pumping rate were reduced to say 2000 gpm, the influent contaminant concentration would increase to 1500 ppb VOC due to decreased dilution from the, now, smaller zone of influence around the well (i.e., cone of depression).

4. Initially, when Well 12A is brought back on-line, the influent contaminant level will be low enough that the 5 tower system will be capable of producing an effluent, of acceptable quality (risk/exposure level) that it can again be used by the City as part of their municipal supply. This point is significant for two reasons: a) Well 12A is a significant contributor to the City's summer water supply needs, and 2) the City Water Division seeks to maximize their benefits from a Well 12A treatment system if they are charged with operating and maintaining the system. Based on Item 3 above, a lower flow rate system, that is, 2000 gpm, and a 3 tower configuration (the cost-effective option at 2000 gpm) would have to treat a higher influent contaminant level. If this were the case, it is estimated that this 3 tower system could not produce an acceptable quality effluent for drinking water purposes and the system effluent would have to be discharged to Commencement Bay. Consequently, the ability to, initially at least, produce a drinking water quality effluent from the Well 12A treatment system is considered to be essential by the City of Tacoma Water Division, and a 3500 gpm system, 5 towers, will permit this.

5. Because there is still much that is unknown about the exact contaminant source and its location, it is possible that the influent contaminant levels at Well 12A could increase beyond the 1000 ppb total VOC anticipated. If this occurs and it is determined that the treatment system effluent is unacceptable (risk/exposure level) for drinking water or discharge to Commencement Bay, the system flowrate could be cut to as low as 2000 gpm. By doing this, the removal efficiency of the five tower system increases from 88% removal of 1,1,2,2 tetrachloroethane to 95% removal thereby increasing the chance that the effluent will acceptable for use or discharge.

   If a 2000 gpm system were installed and influent concentrations increased to a point where the system effluent quality were unacceptable, the only alternative would be to shut down the total well field. Recall that anything less than 2000 gpm will not block the contaminant plume spread through the aquifer. If only Well 12A were shut down and the others were pumped, the contaminant plume would spread as predicted.

6. In summary, a 3500 gpm, five tower configuration provides the most system flexibility in terms of: a) providing a municipal drinking water source; b) minimizing the spread of contamination through the total aquifer; c) increasing the ability to clean up and reactivate Well 9A; and d) providing the option of reduced pumping and treatment if the influent contamination increases to unexpected levels.

Further considerations regarding the recommended treatment system are as follows:

Aesthetics: Five, 12-foot diameter towers, each 50-feet high on the Well 12A site will present some degree of visual impact. The area is predominately a light industrial and residential area. The neutral, light brown color of the fiberglass towers and stack should help to minimize the impact however.

Air Quality: The affect on air quality from the treatment system is insignificant. Table 2, below summarizes the stripper tower emissions for the contaminants of concern. These data are based on the 5-tower system, 3500 gpm flow rate, 88% removal of 1,1,2,2, tetrachloroethane, and a 99% removal of all other components.

TABLE 2

Air Quality Comparisons

Component	Continuous Stack Emissions at stack ppm in air	Maximum 8-hr ground level concentration ppm in air	Current OSHA 8-hr standard ppm in air
1,1,2,2 tetrachloroethane	0.14	0.008	5*
1,2 transdichloroethylene	0.16	0.009	200
trichloroethylene	0.26	0.14	100
tetrachloroethylene	0.004	0.0002	100
TOTAL	0.564	0.1572	405

*NIOSH has recommended a lower standard: 1.0 ppm, 10-hr

As can be seen from Table 2, air quality considerations are insignificant. Regarding odors, for the four contaminants present, the most odorous is trichloroethylene which has a threshold odor level of 20 ppm. At a maximum ambient level of 0.14, there will be no odor detectable.

Noise: Each stripper tower will utilize a 60 hp fan to provide 29,000 cfm of air. Each fan will be equipped with inlet air silencers for noise dampening and will exhibit an overall noise level at all times of 35 dbA measured at the nearest residential property line. For comparison, the following State of Washington noise standards apply:

Night-time residential	-	50 dbA
Day-time residential	-	60 dbA
Day-time commercial	-	65 dbA
Day-time industrial	-	70 dbA

Consequently, operation of the 5 tower system will comfortably comply with all applicable State noise standards.

System Salvage Valve

Although difficult to assign costs to, it must be recognized that the stripper towers being designed for Well 12A will have an inherent salvage value. They could be dismantled, moved and reassembled at another site if their use at Well 12A is no longer required. For example a final remedial action may place a treatment system at or closer to the source of contamination once it's located and a final action plan is developed. This plan could conceivably utilize the towers designed for 12A. Alternatively, there are other municipal well sources in the Tacoma region with similar organic contamination problems already identified. It is highly likely that they too will require forced air stripping, and depending on project timing, could possibly use the Well 12A towers.

Continuing Efforts to Identify the Source

EPA will continue its efforts to determine the extent and magnitude of the contaminated plume and to identify the sources of contamination. This information is necessary to develop and analyze the alternatives for final remedial action for the aquifer.

EPA has just completed preliminary analysis of locations in the Well 12A area having the highest probability of being the source or sources of contamination of the Well 12A aquifer. Locations identified as potential sources are predominately to the north and east of monitoring well CBW-10.

The future investigation will consist of both surface and subsurface work. Analysis of data will continue to narrow down possible pollutant source locations in the unsaturated zone and to further evaluate the groundwater flow system, chemical characteristics, and extent of the plume.

COMMUNITY RELATIONS

A public meeting to discuss this plan is being held by EPA, in conjunction with the Tacoma-Pierce County Health Department, the City of Tacoma, the Washington Department of Ecology, and the Washington Department of Social and Health Services. The meeting is scheduled for 5:00 p.m. Thursday, March 10, 1983 in the Health Department's conference room at 3629 South D in Tacoma, Washington.

Written comments on this feasibility study may be sent to:

Robert Poss
U.S. Environmental Protection Agency
Toxic Substances Control Branch
1200 6th Ave., M/S 524
Seattle, Washington 98101

Comments should be received by Thursday, March 10, 1983.

FIGURE 1

PERCENT REMOVALS OF 1,1,2,2-TETRACHLOROETHANE VS TRANS, TRI, TETRA-CHLOROETHYLENE

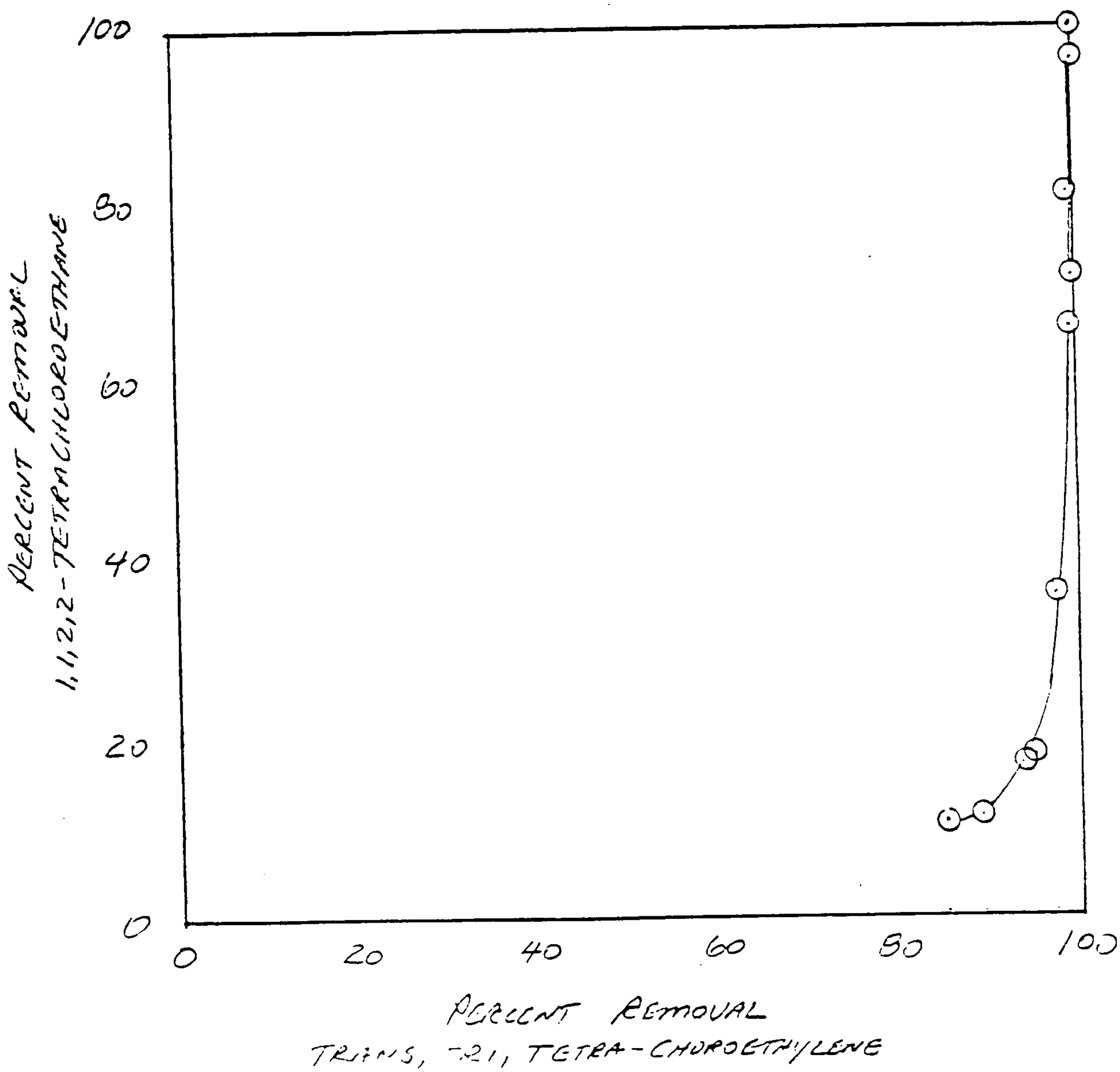
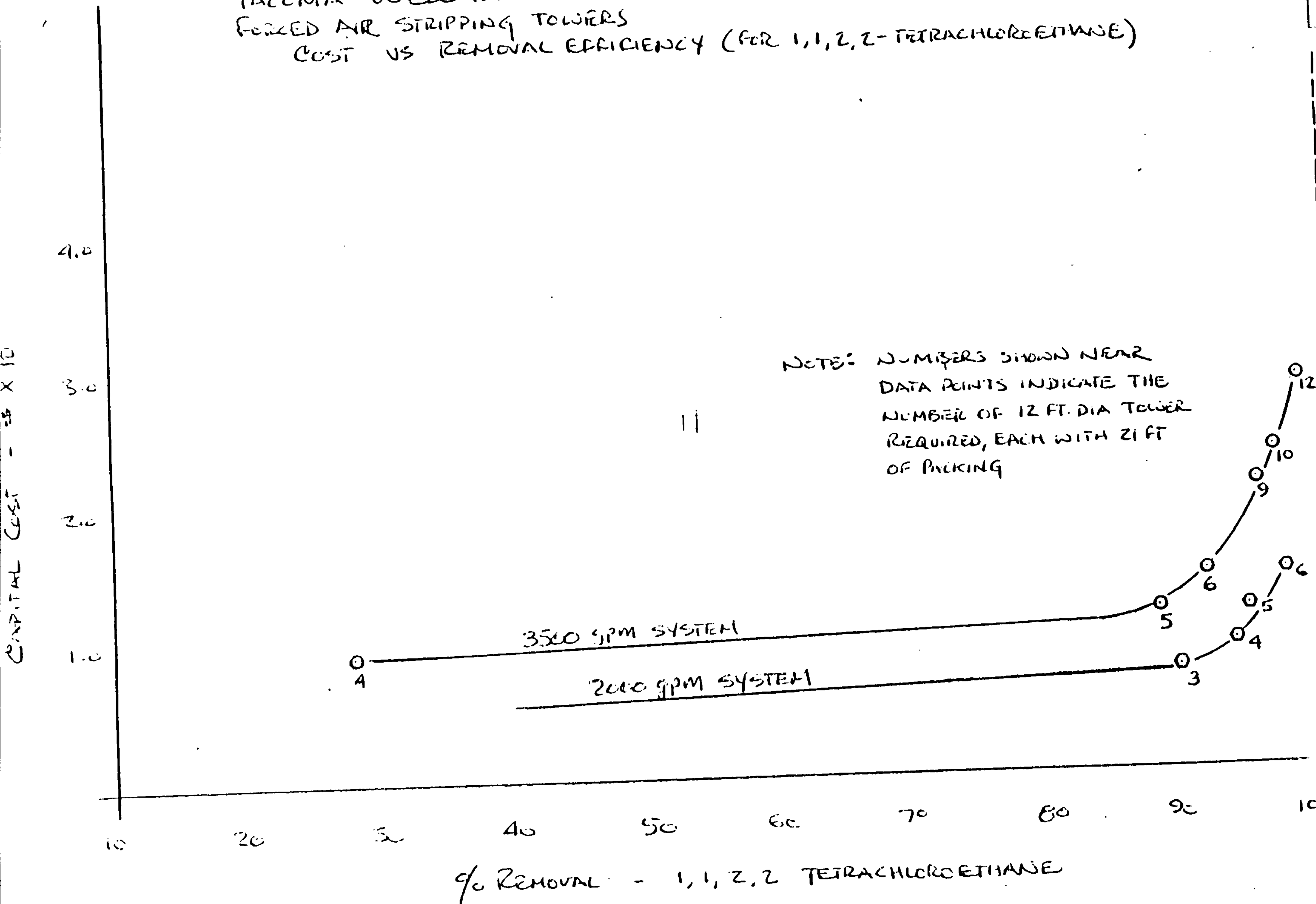


FIGURE 2
TACOMA WELL 12A
FORCED AIR STRIPPING TOWERS
COST VS REMOVAL EFFICIENCY (FOR 1,1,2,2-TETRACHLOROETHANE)



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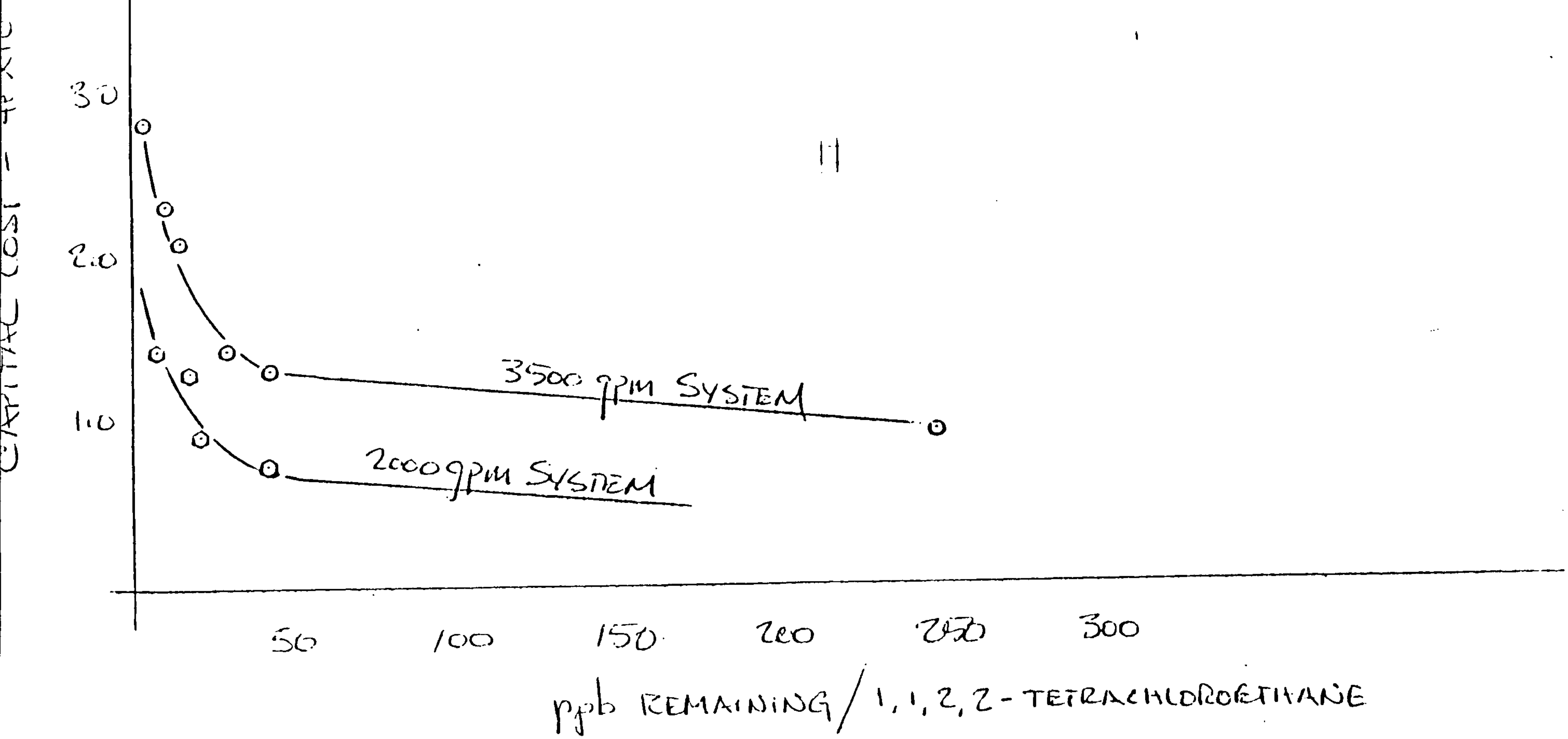
SUBJECT ____ BY ____ DATE ____ SHEET NO. ____ OF ____ PROJECT NO. ____

FIGURE 3
TACOMA WELL 12A.
FORCED AIR STRIPPING TOWER
COST VS. ppb OF 1,1,2,2 – REMAINING



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SUBJECT

BY DATE

SHEET NO. OF

PROJECT NO.

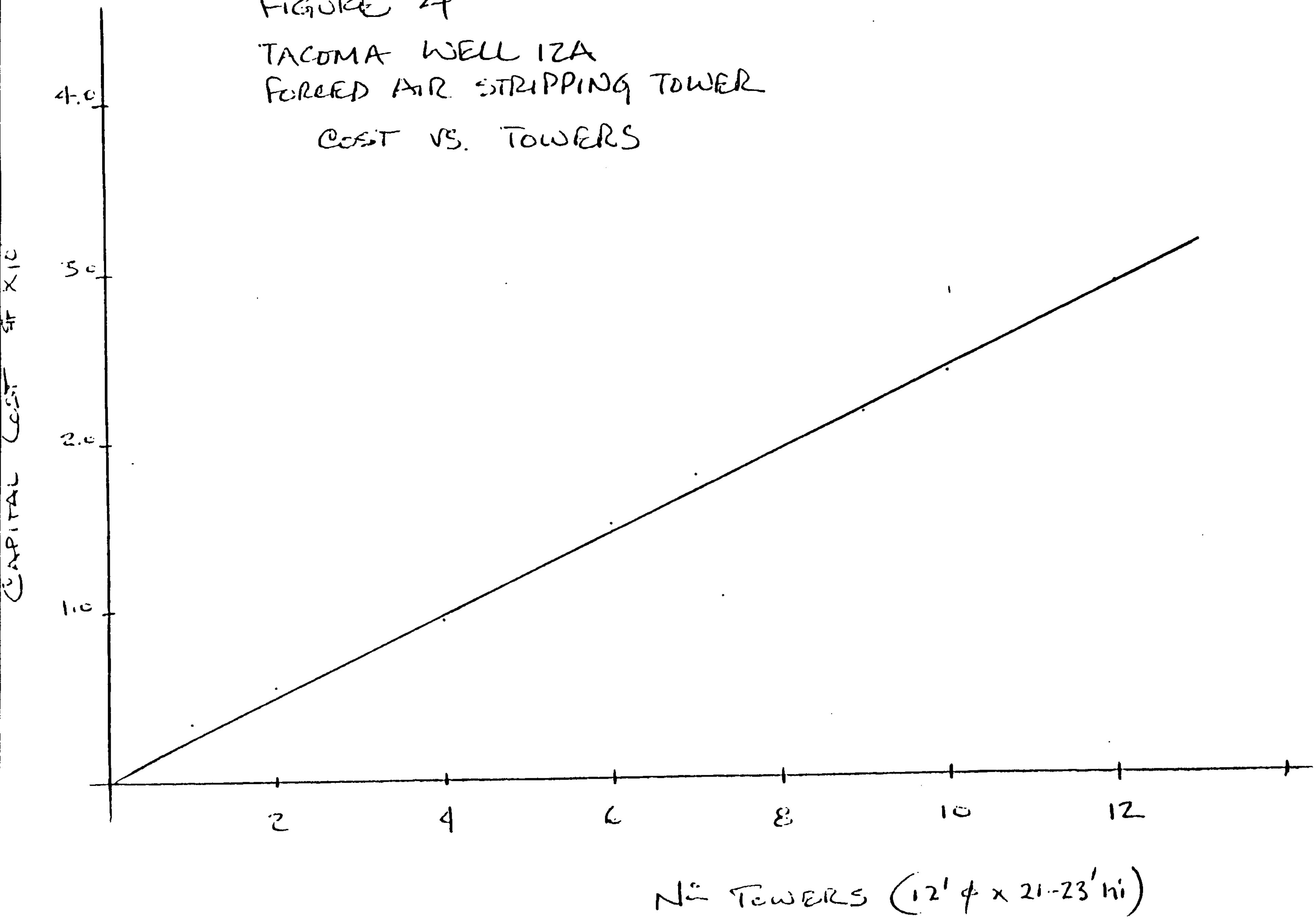
BACKUP DATA TO GRAPHS.

1,1,2,2 —

FLOW	X IN ppb	X OUT - ppb	% REMOVAL	No. TOWERS	COST x10^6	
3500	350	4.1	98.8	12	$2.9	
		10.8	96.9	10	2.38	
		14.8	95.7	9	2.15	
		28.7	91.8	6	1.47	
		42.8	88	5	1.23	
		252	28	4	0.95	
2000	350	7.1	97.7	6	1.47	
		17.84	94.9	5	1.23	
		21	94	4	0.95	
		42.8	89.7	3	0.76	

FIGURE 4

TACOMA WELL 12A
FORCED AIR STRIPPING TOWER
COST VS. TOWERS



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SUBJECT

BY

DATE

SHEET NO. of

PROJECT NO.

RESPONSIVENESS SUMMARY

COMMENCEMENT BAY - SOUTH TACOMA CHANNEL
Initial Remedial Measure - Well 12-A

INTRODUCTION AND OVERVIEW

A public meeting was held in the auditorium of the Tacoma-Pierce County Health Department on March 10, 1983, to discuss EPA's plans for an initial remedial measure at well 12-A. The meeting, which was attended by approximately 60 persons, began at 5:00 p.m. and ended at 6:45 p.m. Organizations with members or representatives commenting at meeting included: Puyallup Nation; Tahomans for a Healthy Environment; John Ladenburg, Tacoma City Council; League of Women Voters; and Council on Aging.

The meeting was announced in late February with a press release and a mailing to over 200 persons and organizations. The draft feasibility study describing the project was on public display at several libraries. Two handouts were available. One was a one-page executive summary of the project. The second was the feasibility study itself. There was adequate media coverage, both before and after the meeting.

The meeting was chaired by Chuck Findley, Superfund Coordinator for EPA Region X. He introduced an expert panel including Bob Rosain, CH2M HILL (the project consultant), Earl Tower, Washington Department of Ecology; John Roller, Tacoma Water Division; Bob James, Washington Department of Social and Health Services; and Dr. Bud Nicola, Tacoma-Pierce County Health Officer.

Mr. Findley described the general Superfund response at well 12-A. He then introduced Mr. Rosain, who described the groundwater problem and the details of the proposed initial remedial measure.

Mr. Findley then called for questions and comments from the audience. A 1-hour dialogue followed.

Comments and questions were generally in support of the proposed action. Negative comments were directed primarily to off-site or non-Superfund issues. The public wants EPA and other agencies to move forward quickly with solving this problem.

The audience applauded the panel as the meeting ended.

SUMMARY OF PUBLIC COMMENT AND AGENCY RESPONSES

The comments or questions raised at the March 10, 1983, meeting and the responses to those questions are summarized below. The comments and responses are organized in four groups: (1) comments on the actions at well 12-A and about the quality of drinking water; (2) comments about other impacts resulting from the proposed treatment system for well 12-A; (3) comments about drinking water quality in areas outside the well 12-A site; and (4) other comments.

Comments on Well 12-A and Drinking Water

Comment/Question - How long were people drinking contaminated water from well 12-A?

Response - We are not sure. The well was shut down as soon as it was known to be contaminated.

Comment/Question - What illnesses might be associated with the contaminants of well 12-A?

Response - At acute toxicity these contaminants cause liver and kidney failure; however, the levels found in well 12-A are far below the levels of acute toxicity. Therefore, the main concern is long-term health effects. We are extrapolating from data on work with lab animals and making conservative assumptions to set the level of these chemicals in the drinking water supply so that no more than one additional cancer death per million people exposed would be expected.

Comment/Question - How long will the contamination in well 12-A go on?

Response - We can't be certain until we have found the source; however, we do expect the pumping at well 12-A along with the natural flow of groundwater to clean up the City of Tacoma's well 9-A in the near future. Well 12-A will serve as a barrier to prevent further contamination of the well field until the source is found.

Comment/Question - What about conservation as an alternative to the summertime pumping of well 12-A?

Response - The City of Tacoma has a conservation program, but they only expect it to reduce water demand by 7 percent. Well 12-A in a well field that serves peak demand in the summer. The wells provide about 30 percent of the city water supply at that time of year, so conservation would be insufficient to replace the well field.

Comment/Question - Isn't there a need for a more aggressive backup system in case the pumping of well 12-A does not provide a barrier to the contamination?

Response - The available evidence indicates that well 12-A has and will serve as a barrier to groundwater flow. The natural movement of groundwater in the aquifer is also tending to push the contamination out of the well field.

Comment/Question - Where else has the air stripper technology been used?

Response - Many places and for several types of applications. In order to provide information on specific locations, the EPA Region X Drinking Water Specialist took names and phone numbers of people interested in this issue so he could get back to them.

Comment/Question - Will this air stripper technology really work on chlorinated hydrocarbons?

Response - Yes. A pilot test has been done at the temperatures expected at the site in summer as well as in worst-case conditions.

Comment/Question - How will it be known that the treatment system will continue working?

Response - The City can respond quickly to changes in well 12-A. The City will test the well daily and can get a fast turnaround from the Weyerhaeuser lab on test results. The City can handle the annual maintenance costs which are estimated at $50,000 to $60,000.

Comment/Question - Does the City have competent people to handle this facility or will they have to be trained.

Response - The City has competent personnel now.

<u>Comments on Other Impacts from Well 12-A</u>

Comment/Question - If treated effluent is not discharged to the City water reservoir, it will go to the City waterway and the bay. One commentor expressed concern about impacts on water temperature and salinity. Several people were concerned about adding any additional contamination to Commencement Bay. This would be in the adjacent Commencement Bay-Nearshore Superfund area.

Response - Commentors were thanked for their input and it was noted that only treated effluent (90 percent or more of contaminants removed) at air temperature would be discharged.

Comment/Question - How much of an impact on air quality will the air stripper towers at well 12-A have?

Response - About 40 pounds per day of contaminants will be emitted while the stripping towers are in use. This compares to about 20 pounds per day from a gas station or 24 pounds from a dry cleaner. The Well 12-A treatment towers will add an insignificant amount to local air pollution.

Off-Site Drinking Water Issues

Comment/Question - Several people asked whether wells in the Tacoma tideflats were contaminated.

Response - The Tacoma tideflats are in an adjacent Superfund area for which the Washington Department of Ecology (DOE) has lead agency responsibility. In March 1983 the DOE submitted a cooperative agreement to EPA for a remedial investigation/feasibility study in the tideflats. An element of this remedial investigation is a determination of whether groundwater is contaminated.

Comment/Question - Several people demanded that EPA find the source and "crackdown."

Response - The remedial investigation completed in February 1983 located a sector to the northeast of well 12-A where the source(s) is most likely to be found. Region X completed a preliminary surface investigation of this suspect area in February, and has initiated an in-depth followup surface investigation which will be completed by April 1983. That investigation will be immediately followed with a supplemental groundwater investigation (i.e., drilling several additional deep wells). It is EPA's expectation that these investigations will be sufficient to locate the primary source(s).

Comment/Question - There was a desire expressed that all City wells be monitored periodically for these contaminants.

Response - The responsibility to monitor the City's water supply is the City's, pursuant to requirements of the health agencies. The Superfund response is limited to controlling the source(s) affecting well 12-A. It is not an umbrella water quality management program.

Comment/Question - It was asked what other areas (such as Lakewood, McChord Air Force Base, Steilacoom) had been tested.

Response - These areas are not part of this Superfund response. It was noted, however, that McChord AFB routinely monitors its wells, and that Lakewood (Ponders Corner) is a proposed NPL site. A remedial investigation has been completed at Lakewood.

Comment/Question - How much more contamination is there was asked by several people.

Response - The remedial investigation at well 12-A isolated only the four chemicals mentioned in the feasibility study. A Superfund investigation was completed in February 1983 in an adjacent area of the South Tacoma Channel known as the South Tacoma Swamp. This area lies to the south of well 12-A and the bulk of the well field, generally in the up-gradient direction. Preliminary results suggest that the swamp is not a major contribution of pollutants to the well field.

Other Off-Site Issues

Comment/Question - The representative of the Puyallup Nation asked whether the Corps of Engineers or the USGS had reviewed the project.

Response - Mr. Findley noted that the critical timing on this project and the fact that it is an initial, not a final, remedial measure precluded formal involvement of the Corps or the USGS.

Comment/Question - It was suggested that wells used by food processors in the tideflats be monitored.

Response - These wells are not in the Commencement Bay-South Tacoma Channel Superfund area, and hence not a subject for this remedial response. They are, however, in the adjacent Commencement Bay-Nearshore Superfund area and should be considered through the cooperative agreement mentioned earlier in this responsiveness summary.

Some questions and comments were not related to this project, nor even to Superfund. These were noted with no response. Examples include: should EPA budget be cut at 45 percent?; and drinking water standards should be upgraded by local or state government if not by EPA.

CONCLUSIONS ABOUT THE MEETING

Comments were generally in support of the proposed action. Comments that were negative were directed primarily to off-site or non-Superfund-related issues. The public wants EPA and other agencies to get on with solving this problem and continue to keep them informed of the measures being taken.